# IDAHO DEPARTMENT OF FISH AND GAME

# ANNUAL REPORT

# KOOTENAI HATCHERY

# 1992

**Prepared by**

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## INTRODUCTION

The Kootenai Tribal Experimental White Sturgeon Acipenser transmontanus Facility is located in Boundary County, Idaho approximately three miles west of the small community of Bonners Ferry (Figure 1). The facility was constructed in the spring of 1991 as a resident fish mitigation measure under the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program [ Section 900 (g) (1) 1987 (H) ; Action Plan, section 1403 (7.5) ]. Funding for this facility was provided by Bonneville Power Administration (BPA) under auspices of the Northwest Power Planning and Conservation Act (P.L. 96-501,1980). This research facility was established for experimental rearing of Kootenai River white sturgeon as part of a BPA project evaluating white sturgeon for the Kootenai River. The facility will release 1- and 2-year old sturgeon in the spring to fall period as directed to meet research objectives. A representative number of fish will be fitted with sonic transmitters so they may be located and tracked after release into the river.

Staffing at the facility includes three permanent Kootenai Tribal personnel. There is no housing at the site, but there is a trailer pad ready for hook-up.

## FACILITY CONSTRUCTION

The facility consists of **a** metal pole building, 17.8 m long and 12.5 m wide, which houses rearing ponds, an office, laboratory space, and a back-up generator. Rearing ponds consist of: two rectangular tanks 3.66 m in length by 0.36 m wide by 0.45 m high; one rectangular tank 3.66 m in length by 0.56 m wide by 0.30 m high; one rectangular tank 3.09 m in length by 0.37 m wide by 0.47 m high; ten rectangular tanks 1.20 m in length by 0.60 m wide by 0.40 m high; three rectangular tanks 1.20 m in length by 0.45 m wide by 0.57 m high; three circular tanks 3.06 m in diameter by 1.53 m high and three 1.53 m diameter circular tanks and 1.22 m high.

## WATER SUPPLY

The facility has two water supply systems, Kootenai River water and Bonners Ferry city water. The Kootenai River water system is pumped into a head-box at about 947 1/min and is distributed for adult holding, incubation, and rearing. The gravity-fed city water is first dechlorinated through two activated charcoal canisters. Then the water goes through a column packed with aeration media (shot shell wads) and then into a head-box for distribution. This flow of 94.7 1/min. is used for incubation, rearing, and recovery of female spawners. The Kootenai River water temperature varies by season from a low of 1°C in the winter and as warm as 17°C to 18°C in the summer. The city water temperature also varies by the season as low as 4°C in the winter, and as warm as 17°C in the summer. An electric water heater is used on the city water in the winter, increasing the water temperature to 17°C in three rearing tanks.

## BROODSTOCK COLLECTION

From April through June of 1992, white sturgeon broodstock were collected from the Kootenai River between Fleming Creek and Massacre Rock. Fish were captured only by angling this year (Table 1). Captured fish were placed upside down in a stretcher suspended across the boat gunwales, with river water added

as needed. Fish were then sexed in the field, either by making a 1-cm abdominal incision and viewing gonadal tissue with a veterinarian otoscope, or by inserting a flexible plastic tube and extracting developing oocytes (eggs) by suction. Once the sex was determined and stage of sexual maturation determined, it was decided whether to bring the fish to the facility by boat or by truck, or to release it. A total of 13 mature fish, 3 females and 10 males, were collected and transported to the facility. All fish captured were tagged with a 30-cm spaghetti type floy tag attached through the base of the dorsal fin, PIT-tagged, and weight and total length recorded.

## STAGING BROODSTOCK

Adult female sturgeon brought to the facility were held in the large 3 m circular tanks and examined about every three weeks for egg development and level of maturation. The fish to be examined were guided into a stretcher so the head of the fish was enclosed in the stretcher hood. Once the fish was secured in the stretcher it was rolled ventral side up and inclined slightly towards the head, keeping the gills in water and the ventral surface dry. In preparation for examination, the abdominal area anterior to the vent was treated with 4% Nitrofurazone Antibacterial solution. Using a scalpel with a size ten blade, a 1-cm incision was made along the ventral midline, approximately three to four ventral scutes anterior to the vent. Care was taken to cut just through the interior cavity lining. An egg sample was removed by aspiration using 4-mm internal diameter tygon tubing. A sample of about 100 eggs was drawn into the tubing and placed into a 150 ml beaker containing 50 ml of chilled Leibovitz (L-15) solution medium. After the sample was collected, the incision was closed and sutured using a cruciate suture. Suture material used was Ethicon's cutting CP-2 (888) reverse cutting edge swedged to a 70-cm sterile chromic gut suture. Care was taken to leave some slack in the suture to allow for swelling of the tissue during healing. The incision area was then washed with a 4% solution of Nitrofurazone. After the examination, the fish was released back into the 3-m circular holding tank.

The four criteria we used to determine probability and time of optimal egg maturity of a potential spawner were: 1) appearance, shape, color, and atresia of eggs; 2) egg diameter through long axis; 3) position of the germinal vesicle (GV); 4) Progesterone maturation assay producing GV breakdown (GVBD). As eggs develop, they generally change from light grey to dark grey or black and from round to oval or irregular shaped. The amount of atretic eggs in a sample indicates a female is reabsorbing eggs and may not continue to develop in a positive direction.

Egg diameter varies with individual fish, but it is helpful in determining positive development. This measurement can suggest that from examination to examination of an individual female, if egg diameter is increasing, maturation is continuing to progress. Egg diameter through the long axis was measured by lining up 10 eggs along a millimeter ruler.

A portion of the egg sample was placed in a 150-m1 beaker with 50 ml L-15 medium, placed on a hot plate, and boiled for 5 to 8 minutes. This solidified the yolk and fixed the position of the GV. The sample was then cooled, and the GV position was determined by bisecting the eggs under a dissecting microscope. Each egg is held with a pair of Adson-Brown tissue forceps and cut along the animal-vegetal axis with a single-edged razor blade. The GV position and the yolk polarization could then be evaluated. Eggs were categorized from stage 1 through 5. In stage 1, the GV is located centrally, and stage 5 is when the GV lies in the cortical ooplasm of the animal pole. Stages 2, 3, and 4 are a progression of the GV from central to the outer cortex of the animal pole. Eggs

with a GV position of stage 4 and 5 represent females with a good chance of being induced to spawn.

The most important criteria used in staging potential female broodstock was progesterone maturation assay of eggs. Eggs were removed from the chilled L-15 medium and placed into a four-well tissue culture plate containing 20 ml of incubation medium each. Then 0.1 ml of progesterone maturation stock solution was added to two culture wells, leaving two wells as a control. The tissue culture plate containing 25 eggs in each well was incubated for 24 hours at 15°C. The absence of a GV after exposure to progesterone maturation steroid for 24 hours is termed germinal vesicle breakdown (GVBD). After incubation, the sample was placed in separate 150-ml beakers boiled for 5 to 8 min, and then cooled. A portion of each sample was fixed in 10% buffered formalin for future maturation criteria. The eggs were then bisected along the animal-vegetal axis and examined for GVBD. Normally, a female that will successfully spawn will exhibit GVBD in 80% or more of the eggs assayed.

## FIRST SPAWN 1992

Female tag #1697, captured on May 19, was transported to the facility where she was staged. She had an egg diameter of 3.2 mm and a GV position of stage 4. A progesterone assay was performed on the eggs on May 28, with only 60% exhibiting GVBD, although the texture and color were both positive.

On June 8, she was staged again with more favorable results. The eggs had a diameter of 3.4 mm and the GV position was stage 4-5 with > 90% of the eggs exhibiting GVBD; it appeared she could be induced to spawn.

Hormone injections to induce spawning began on June 10. She was injected with a primary injection of 10% of a 0.1 mg/kg body weight dose of luteinizing hormone releasing hormone analogue (LHRHa) at 2135 hours. Twelve hours later, she was given a resolving dose of 90% of the 0.1 mg/kg body weight LHRHa. Prior to the induction injections, she was placed by stretcher into a 1.0 x .67 x 3.0 meter covered fiberglass holding tank. The holding tank allowed the fish to be injected under water, reducing stress and handling. This also makes for easier observation while waiting for ovulation.

Three males (numbers 1240, 1696, 1687) had milt when checked at 1500 hours on June 9. A total of 30 ml of milt was collected from each. A sample of milt from each male was checked by microscope for motility and time to death. The remaining milt was placed in ziplock plastic bags with pure oxygen and stored in a refrigerator. Care was taken to keep the tubing, syringe, and surface area of the fish dry when collecting sperm.

Ovulation was expected between 24 to 48 hours post-resolving injection on June 12. Approximately 500 dark eggs were observed about 47 hours post-resolving injection, floating near the bottom of the holding tank. This was not a good sign, as viable eggs stick to the bottom of the tank. We continued to observe her until 0130 hours on June 13 when she was checked and found to be overripe. Why or how this happened, when the eggs looked so good, is still undetermined. It may have been stress-related response or reaction to the hormone. She was again examined by the hatchery staff and released at 1000 hours.

## SECOND SPAWN 1992

On June 15 the two remaining females were staged. Female #1683 was overripe, the eggs were ringed with white, and the texture was uneven. Female

01699 had progressed to stage 5, the egg diameter had increased to 3.0-3.1 mm from 2.8-2.9 mm, and the color and texture were both positive.

Hormone injections for female 01699 to induce spawning began on June 16. She was injected with a primary injection of 10% of a 0.1 mg/kg body weight dose of LHRHa at 1800 hours. Eighteen hours later, she was given a resolving dose of 90% of the 0.1 mg/kg body weight LHRHa. This was recommended by the University of California at Davis (U.C. Davis) to reduce stress on the female and bring an early ovulation of approximately 24 hours.

Three males (#'s 1240, 1691, 1541) had milt when checked on June 16. A total of 40 ml of milt was collected from each. A sample of milt from each male was checked by microscope for motility and time to death. The counts were good, except 01240 which was lower, but motility was two minutes plus for all. Sperm collection techniques remained the same.

Ovulation began 18 hours post-resolving injection on June 18. Approximately 200 dark eggs were observed stuck to the bottom of the holding tank at 0545 hours. Fresh milt was collected from the males at 0600 hours on June 18. At approximately 0845, egg removal procedure was started, the female was placed in the stretcher and supported over the holding tank. A length of tygon tube connected to the hatchery water supply was placed into her mouth for aeration. The ventral side was disinfected with 4% nitrofurazone. A 10-cm incision was made along the midline to expose the egg mass, then the eggs were gently removed with a plastic spoon from the body cavity. A sample for contaminate analysis of at least 70 g of eggs were removed and frozen. The eggs were placed into nine stainless steel bowls to await fertilization. This process took approximately 60 minutes. Three 10-g egg samples were collected and counted later to determine fecundity. She was thoroughly disinfected with 4% nitrofurazone and the incision was closed with Ethicon's PDSII violet monofilament (polydioxanone) suture swedged to a reverse cutting CP-1 curved, surgical needle. A continuous suture of both the inside and outside body cavity wall was used. She was placed back into the holding tank at 1000 hours. After three hours, she was checked and then transferred to the recovery tank.

Egg fertilization and processing began at 0940 hours. The coelomic fluid was removed from the eggs. A 10-ml sperm sample was poured into a bowl of 2,000 ml of water. This mixture was then stirred and added to the eggs, then gently stirred with feathers until the eggs began to stick to the feathers; approximately 2 minutes later. This process was performed with sperm from each male and for each of the three water experiments, for a total of nine samples which were kept separate (Table 2). The bowls were drained off and the de-adhesive solution of Fullers Earth (diatomaceous earth) mixed with water, which was set in flowing water for tempering. It was then added to the eggs and again gently stirred until the eggs were no longer sticky. Constant monitoring of the egg temperature was done, so when the egg mixture increased more than 5°C, it was poured off and new tempered mix was added. This process lasted 75 minutes. The eggs were thoroughly rinsed to remove excess material and placed into 11 MacDonald jars; four on regular city water, four on heated city water, and three on Kootenai River water. There were approximately 13,000 eggs per jar. The flow was set at 3.79 1/min/jar. This flow rate kept the eggs suspended but not rolling. A total of 4,280 ml of eggs at 30.6 eggs/ml were removed from the fish for a total of 130,968 eggs.

## INCUBATION AND EARLY FRY REARING

At 2300 hours, 12 hours post-fertilization, random egg samples were taken from the bottom, middle, and top of the incubators. Samples were also taken from each male and water source. We then recorded the number of eggs and their stage

of development under the dissecting microscope (Table 2). The water flow was increased 48 hours post-fertilization to roll the eggs and reduce fungus clumping. With water temperatures of 18°C to 20°C for both heated city and Kootenai River water, fungus clumping had already occurred, and most egg mortality (99.99% of those groups) occurred at this time. Regular city water temperature was approximately 15°C, with much better survival to hatch (Table 3). Hatching began 4.5 to 5 days post-fertilization on Kootenai River water and heated city water. On regular city water, hatching began 7 days post-fertilization. Hatching lasted for 3 days. The late hatching larvae, from the three water sources, showed a high incidence of deformity. Total hatching produced 22,027 larvae on regular city water, heated city water produced 487 larvae, and 379 were produced on Kootenai River water (Figure 2).

Larvae were allowed to swim out of the MacDonald jars directly into emergence tanks.

The three different lots of larvae on regular city water were split up, weighed, and sampled into lots according to their male numbers 1240, 1691, and 1541. They were kept separated by screens in two rectangular tanks 3.66 meters in length by 0.36 meters wide by 0.45 meters high. The remaining larvae from heated city water males #1240 and #1541 were transferred into the Kootenai River lots from males #1240 and #1541. The male #1691 larvae from the Kootenai River lots and heated city water lots were placed with the male #1691 on regular city water.

Feed initiation began 10 days post-hatch. The larvae were not actively feeding at first, but the exposure to feed seemed to help stimulate feeding in the larvae in time.

## FEED EXPERIMENT

This experiment was to test the growth and survival of the larvae on two different diets. This year, we tested Bio-Kyowa larvae feed 250, 400, and 700 on 9,087 larvae. This was the diet used in 1991 at the Kootenai facility. We also tested Rangen Soft Moist diet on a total of 9,905 larvae. During the day, the larvae were fed on the sides of the tanks by hand and with double AA-100 brand fish sitters. At night, they were fed only with automatic feeders (AA-100). The larvae started on Rangen Soft Moist were growing approximately the same, but the mortality was less (Figure 3). With the cost of Bio-Kyowa at $74.00/kg, and the additional mortality when diets are changed, the larvae were changed from Bio-Kyowa to Rangen Soft Moist diet, which cost $0.97/kg after approximately 30 days.

## FISH TRANSFERS

On June 18, approximately 10,000 green eggs were transferred from the Kootenai Tribal Experimental White Sturgeon Facility to Sandpoint Fish Hatchery for hatching. On June 30, approximately 3,700 additional larvae were transferred to Sandpoint Hatchery to increase their dwindling sturgeon population. Also on November 3, 728 fingerling sturgeon were transferred to Sandpoint Hatchery to reduce overcrowding at the Kootenai Facility.

## MORTALITY AND SURVIVAL

The majority of the mortality occurred with the fungus clumping of the eggs in the incubators, and in the first 20- to 45-day period while feed training. To improve survival this year, no handling was attempted until the larvae became at least 76 mm in length. Last years survival was approximately 1%; this years survival was approximately 10% from commencement of feeding to December 31.

Mortality and growth between fish reared on city water and Kootenai River water were not separated this year. This experiment was done in 1991, and proved that sturgeon could be reared from egg to release of Kootenai River water. For Sandpoint Fish Hatchery's mortality and growth see Patterson (1992). Mortality and growth for the Kootenai Facility is in Table 4.

## FISH HEALTH

The losses due to egg fungus was the majority of mortality at the facility this year. The larvae, through fingerling, continued to have generally good health until overcrowding began putting stress on the population, and mortality began to increase on November 27. Previously, when mortality increased, a 1% salt bath was utilized with success. This time, the salt bath did little or nothing to reduce this mortality. Samples were sent to the Idaho Fish and Games Fish Health Lab in Eagle, Idaho and to U.C. Davis for analysis. The majority of the fish mortality, 80 brood year 1991 and 2,596 brood year 1992, perished by December 15. This outbreak left approximately 1,785 brood year 1992 fingerlings at the facility by the end of December. Mortality was at normal by December 15, with only a few fish showing symptoms of any problems. The presumptive diagnosis from U.C. Davis was a White Sturgeon Virus; the specific determination as to the particular strain was pending culture protocol at this writing.

## BROOD YEARS 1990 AND 1991 TO RELEASE

All brood year 1991 sturgeon large enough to PIT tag were tagged at both the Sandpoint Fish Hatchery and Kootenai Facility. Sandpoint's fish were transported to the Kootenai Facility to acclimate to the Kootenai River water. The smaller sturgeon from the Sandpoint Hatchery, along with fish reared at the Cabinet Gorge Hatchery, were transported and placed in tanks with city water to continue to grow for holdover and future release.

The fish that were to be released into the Kootenai River, approximately mid-August, were being held in large circular tanks on Kootenai River water. On the night of August 2 or early morning of August 3, a blown fuse between the back-up generator and the pump relay stopped the pump and caused an oxygen deficiency to the sturgeon held for release. A total of 742 fish from brood year 1991 and 43 fish from brood year 1990 perished. As a result of this loss, only 200 brood year 1991 sturgeon, mean length 25.5 cm and mean weight 65.4 g, were released in two sites on the Kootenai River on August 26. Massacre Rock and Smith Island were selected as release sites. Along with the brood year 1991 fish, seven per site of the brood year 1990 fish were also released. The mean length was 45.5 cm and the mean weight was 321 g. Six sturgeon of brood year 1990 were fitted with 40-day mini transmitters for habitat preference of juveniles.

## NEW CONSTRUCTION

A settling tank was installed and put into operation for rearing water. This will help with the silt problems in the Kootenai River water system during the spring run-off.

The installation of two alarm systems, a new breaker box, and rewiring of the river pump system was completed.

All of the semi-square or rectangular tanks used for fish rearing were installed this year.

Construction has begun on a back-up river pump, a pump house, and water line for the Kootenai River water system.

## PUBLIC RELATIONS

Approximately 150 people attended the June 1 open house at the facility. Most were local residents.

Nearly 500 people toured the facility during 1992. Also, we have given tours to students from schools in nearby communities.

## RECOMMENDATIONS

Broodstock:

1. Broodstock should be transported to the facility as soon as possible following collection to reduce stress.

2. Fish should be checked regularly to determine degree of maturation.

3. At least three females should be at the facility one month prior to spawning.

4. One of these females should have spawned at least once before.

Spawning:

1. Have a male to female ratio of 3:1.

2. Use three separate bowls to fertilize the eggs.

3. Keep them sorted by the male's number from incubation through stocking, or until overcrowding becomes a problem.

4. Transfer a portion of the eggs to Sandpoint Fish Hatchery to hatch and rear on heated spring water, not to exceed 10°C.

Rearing: Same as last year.

KOOTENAI

Incubation:

1. Do not use water warmer than 15°C for incubation.

2. Continue experimental incubation using Kootenai River water to provide a replicate of the natural environment.

Feed: Continue to do feed experiments on the larvae to increase survival and growth.

## TIME ALLOCATION

The time the hatchery staff allocated to the different phases of hatchery management is represented in Figure 4.

Table 1. Kootenai River broodstock collection data for 1992.

| FLOY TAG NUMBER | PIT TAG NUMBER | CM FORK LENGTH | WEIGHT IN KG | DATE CAUGHT | DATE RELEASED | USED IN SPAWN | SEX | RIVER KM CAUGHT |
|---|---|---|---|---|---|---|---|---|
| 1691 | 7F7F3B6160 | 190 | | 05/13/92 | 06/29/92 | YES 2ND | M | 231.1 |
| 1697 | 7F7F442851 | 180 | 57.0 | 05/19/92 | 06/13/92 | YES 1ST | F | 230.9 |
| 1683 | 7F7F425063 | 160 | 28.0 | 05/19/92 | 06/21/92 | NO | F | 230.9 |
| 1679 | 7E7E426F66 | 238 | | 05/19/92 | 05/21/92 | NO | F | 230.9 |
| 1699 | 7F7F427055 | 162 | 40.0 | 05/20/92 | 10/11/92 | YES 2ND | F | 230.9 |
| 1696 | 7F7F441065 | 147 | 24.5 | 05/21/92 | 06/29/92 | NO | M | 230.1 |
| 1687 | 7F7F42776E | 171 | 37.0 | 05/21/92 | 06/29/92 | NO | M | 230.1 |
| 1686 | 7F7F442946 | 133 | | 05/21/92 | 06/09/92 | NO | M | 231.1 |
| 1240 | 7F7F137816 | 205 | 62.0 | 05/21/92 | 06/29/92 | YES 2ND | M | 231.1 |
| 1682 | 7F7F426374 | 138 | | 06/11/92 | 06/29/92 | NO | M | 244.5 |
| 1680 | 7F7F423420 | 151 | | 06/11/92 | 06/09/92 | NO | M | 230.9 |
| 1541 | 7F7F403768 | 142 | | 06/11/92 | 06/29/92 | YES 2ND | M | 244.5 |

NOTE: Missing weights were not recorded because scales were broken or left behind



KOOTTBLS

Table 2.0. Egg development separated by male floy tag number and water supply, 1992.

| TIME LAPSE | TAG NO | EGGS VIEWED | EAR CLVG | ADV CLVG | LATE CLVG | EAR GSTR | % FERT |
|---|---|---|---|---|---|---|---|
| 12 HRS | 1240 | 95 | 2 | 71 | | | 77 |
| | 1541 | 99 | 3 | 89 | | | 89 |
| | 1691 | 100 | 5 | 90 | | | 90 |
| | | | GSTR | YOLK PLUG | EAR NEUR | NEUR TUB | |
| 24 HRS | 1240 | 74 | 70 | | | | 95 |
| | 1541 | 69 | 66 | | | | 97 |
| | 1691 | 89 | 84 | | | | 94 |
| | | | EAR YOLK | YOLK PLUG | EAR NEUR | NEUR TUB | |
| 48 HRS | 1240 | 78 | | 17 | 53 | | 90 |
| | 1541 | 55 | | 8 | 46 | | 98 |
| | 1691 | 103 | | 15 | 86 | | 98 |
| | | | EAR NEUR | NEUR TUB | LATE NEUR | | |
| 72 HRS | 1240 | | | | | | |
| | 1541 | | | | | | |
| | 1691 | 101 | | | 86 | | 85 |
| | | | EAR NEUR | NEUR TUB | LATE NEUR | | |
| 96 HRS | 1240 | | | | | | |
| | 1541 | | | | | | |
| | 1691 | 29 | | | 25 | | 86 |
| | | | | | | | |
| 120 HRS | 1240 | HATCHED | | | | | |
| | 1541 | HATCHED | | | | | |
| | 1691 | HATCHED | | | | | |

KOOTENAI RIVER WATER

KOOTTBLS

Table 2.1. Egg development separated by male floy tag number and water supply, 1992.

| TIME LAPSE | TAG NO | EGGS VIEWED | EAR CLVG | ADV CLVG | LATE CLVG | EAR GSTR | % FERT |
|---|---|---|---|---|---|---|---|
| 12 HRS | 1240 | 65 | 41 | | | | 63 |
| | 1541 | 123 | 108 | 3 | | | 90 |
| | 1691 | 153 | 144 | | | | 94 |
| | | | GSTR | YOLK PLUG | EAR NEUR | NEUR TUB | |
| 24 HRS | 1240 | 73 | 35 | | | | 48 |
| | 1541 | 88 | 86 | | | | 98 |
| | 1691 | 98 | 98 | | | | 100 |
| | | | EAR YOLK | YOLK PLUG | EAR NEUR | NEUR TUB | |
| 48 HRS | 1240 | 70 | | 37 | 24 | | 87 |
| | 1541 | 53 | | 18 | 33 | | 96 |
| | 1691 | 98 | | 45 | 51 | | 98 |
| | | | EAR NEUR | NEUR TUB | LATE NEUR | | |
| 72 HRS | 1240 | 50 | | | 30 | | 60 |
| | 1541 | | | | | | |
| | 1691 | | | | | | |
| | | | EAR NEUR | NEUR TUB | LATE NEUR | | |
| 96 HRS | 1240 | | | | | | |
| | 1541 | | | | | | |
| | 1691 | 79 | | | 5 | | 6 |
| | | | | | | | |
| 120 HRS | 1240 | HATCHED | | | | | |
| | 1541 | HATCHED | | | | | |
| | 1691 | HATCHED | | | | | |

HEATED CITY WATER

KOOTTBLS

Table 2.2. Egg development separated by male floy tag number and water supply, 1992.

| TIME LAPSE | TAG NO | EGGS VIEWED | EAR CLVG | ADV CLVG | LATE CLVG | EAR GSTR | % FERT |
|---|---|---|---|---|---|---|---|
| 12 HRS | 1240 | 39 | 8 | | | | 20.5 |
| | 1541 | 100 | 80 | | | | 80 |
| | 1691 | 107 | 76 | | | | 71 |
| | | | ADV CLVG | LATE CLVG | EAR NEUR | NEUR TUB | |
| 24 HRS | 1240 | 73 | 47 | 1 | | | 66 |
| | 1541 | 63 | | 60 | | | 95 |
| | 1691 | 130 | | 129 | | | 99 |
| | | | EAR YOLK | YOLK PLUG | EAR NEUR | NEUR TUB | |
| 48 HRS | 1240 | 70 | 19 | 19 | | | 54 |
| | 1541 | 81 | 7 | 67 | | | 91 |
| | 1691 | 126 | 14 | 54 | | | 86 |
| | | | EAR NEUR | NEUR TUB | LATE NEUR | | |
| 72 HRS | 1240 | | | | | | |
| | 1541 | | | | | | |
| | 1691 | 103 | | | 92 | | 89 |
| | | | EAR NEUR | NEUR TUB | LATE NEUR | | |
| 96 HRS | 1240 | | | | | | |
| | 1541 | | | | | | |
| | 1691 | 105 | | | 88 | | 84 |
| | | | EAR NEUR | NEUR TUB | LATE NEUR | | |
| 120 HRS | 1240 | | | | | | |
| | 1541 | | | | | | |
| | 1691 | 115 | | | 88 | | 77 |
| | | | | | | | |
| 211 HRS | 1240 | HATCHED | | | | | |
| | 1541 | HATCHED | | | | | |
| | 1691 | HATCHED | | | | | |

REGULAR CITY WATER

KOOTTBLS

Table 3. Egg survival through hatching separated by male and incubation water used for female #1699.

| Tag No. | Egg Size #/ml | Number of ml | Number of eggs | Eggs hatched | Percent hatched |
|---|---|---|---|---|---|
| Normal City Water | | | | | |
| 1240 | 30.6 | 230 | 7,038 | 635 | 9.02 |
| 1691 | 30.6 | 1,230 | 37,638 | 17,618 | 46.81 |
| 1541 | 30.6 | 500 | 15,300 | 3,774 | 24.67 |
| | | | | | |
| Heated City Water | | | | | |
| 1240 | 30.6 | 250 | 7,650 | 6 | 0.08 |
| 1691 | 30.6 | 870 | 26,622 | 455 | 1.71 |
| 1541 | 30.6 | 270 | 8,262 | 26 | 0.31 |
| | | | | | |
| Kootenai River Water | | | | | |
| 1240 | 30.6 | 310 | 9,486 | 174 | 1.83 |
| 1691 | 30.6 | 410 | 12,546 | 101 | 0.81 |
| 1541 | 30.6 | 210 | 6,426 | 104 | 1.62 |
| | | | | | |
| TOTALS | | 4,280 | 130,968 | 22,893 | 17.48 |

Table 4. Kootenai White Sturgeon facility mortality and growth for 1992.

| DATE | NUMBERS | MORTS | PERCENT SURVIVAL | WEIGHT IN KG | GRAMS/ FISH | FISH/ POUND | LENGTH IN CM | AVERAGE TEMP C |
|---|---|---|---|---|---|---|---|---|
| 07/01/92 | 22,893 | 0 | 100.00 | 0.92307 | 0.041 | 11073 | 1.34 | 15.98 |
| 08/01/92 | 8,911 | 9,902 | 46.43 | 7.93078 | 0.89 | 510 | 5.47 | 17.40 |
| 09/01/92 | 6,611 | 2,001 | 34.44 | 59.76344 | 9.04 | 50 | 11.79 | 14.90 |
| 10/01/92 | 5,448 | 1,171 | 28.40 | 45.00048 | 8.26 | 55 | 11.39 | 12.30 |
| 11/01/92 | 4,817 | 631 | 25.10 | 57.51498 | 11.94 | 38 | 12.90 | 9.65 |
| 12/01/92 | 3,129 | 1,252 | 16.95 | 34.88835 | 11.15 | 41 | 12.60 | 5.39 |
| 12/31/92 | 1,785 | 1,344 | 9.70 | 22.77660 | 12.76 | 36 | 14.38 | 5.39 |

NOTE: We moved 3,700 larvae (July 3) and 728 fish (November 3) to Sandpoint Hatchery.

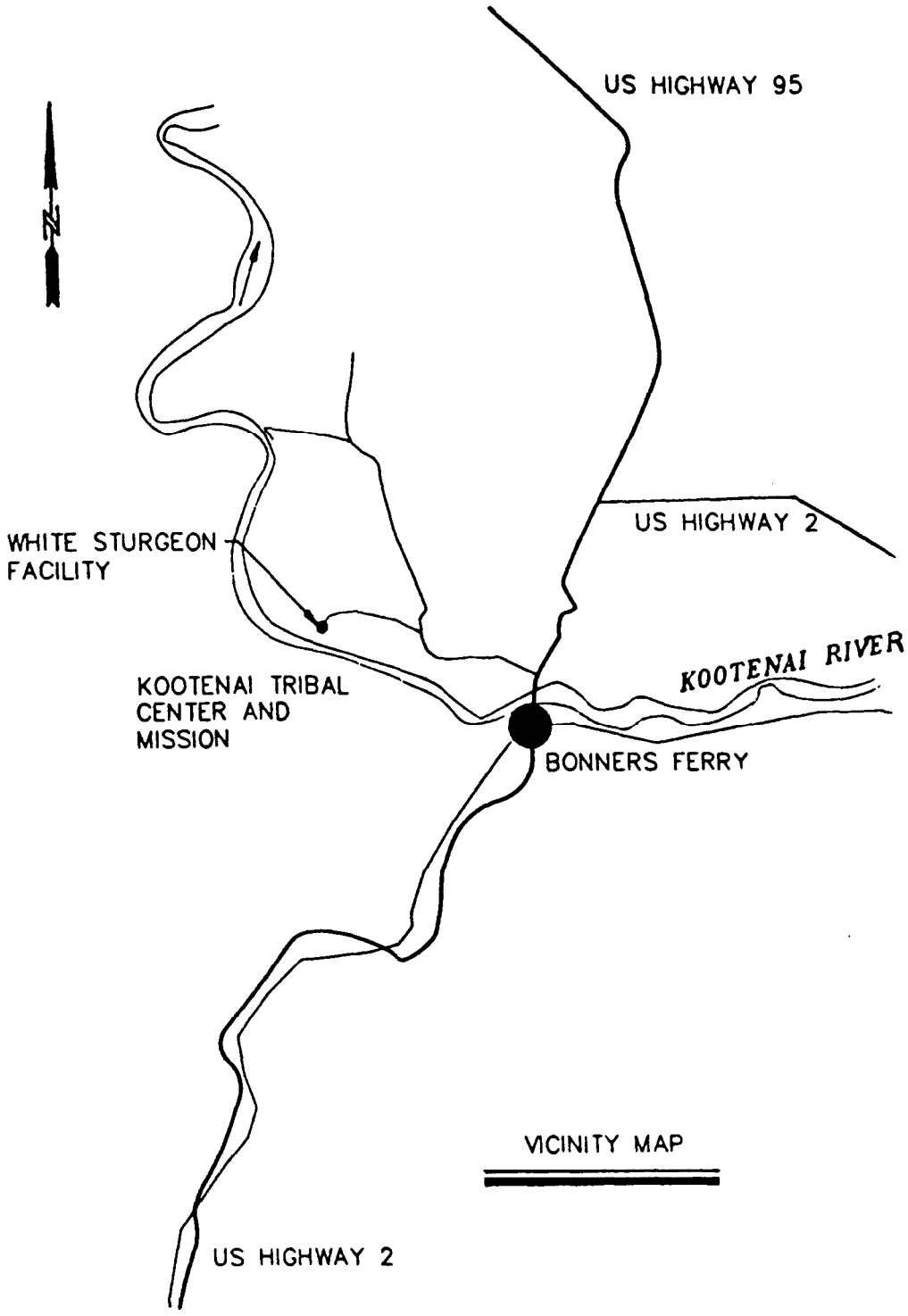
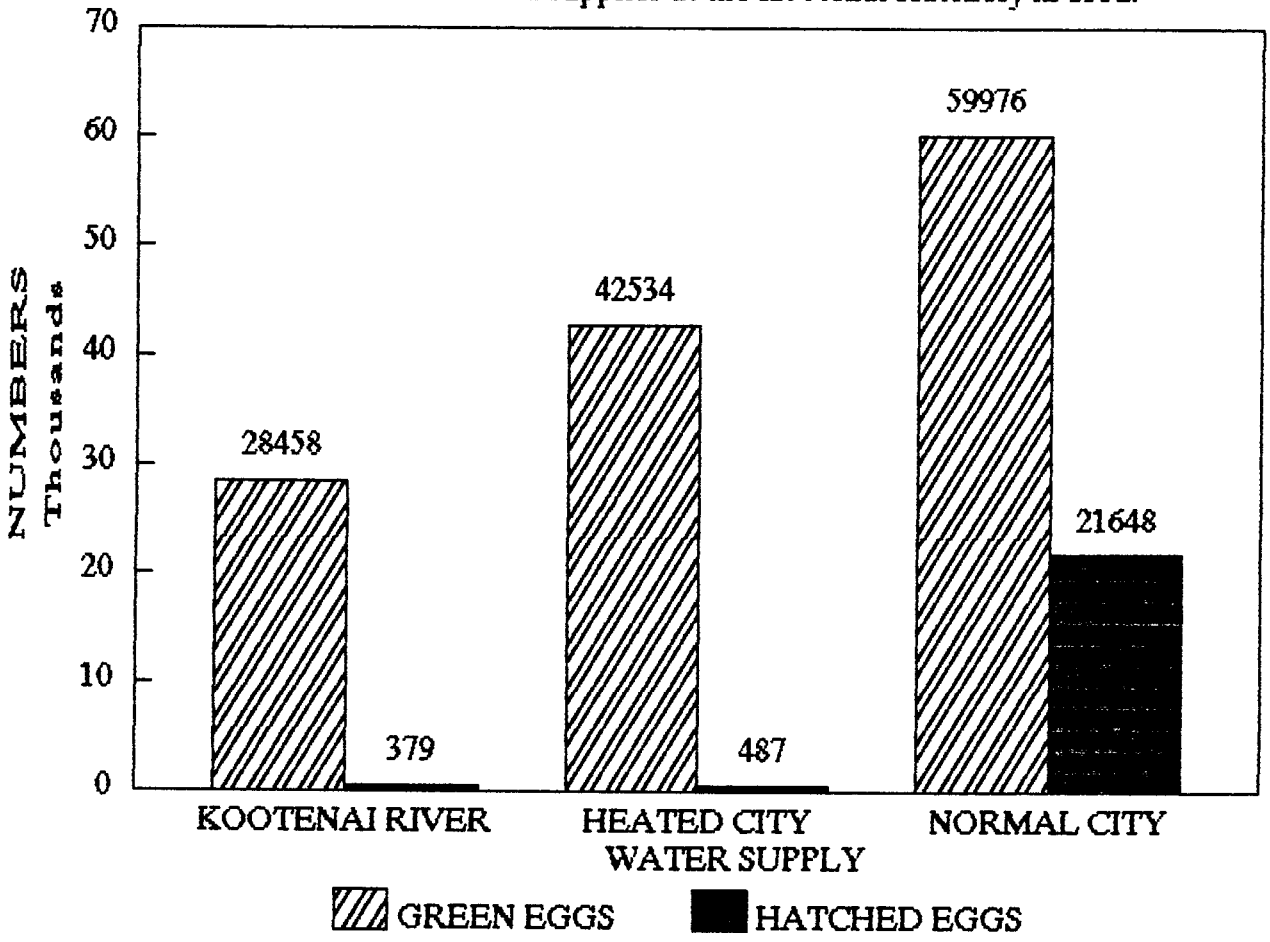
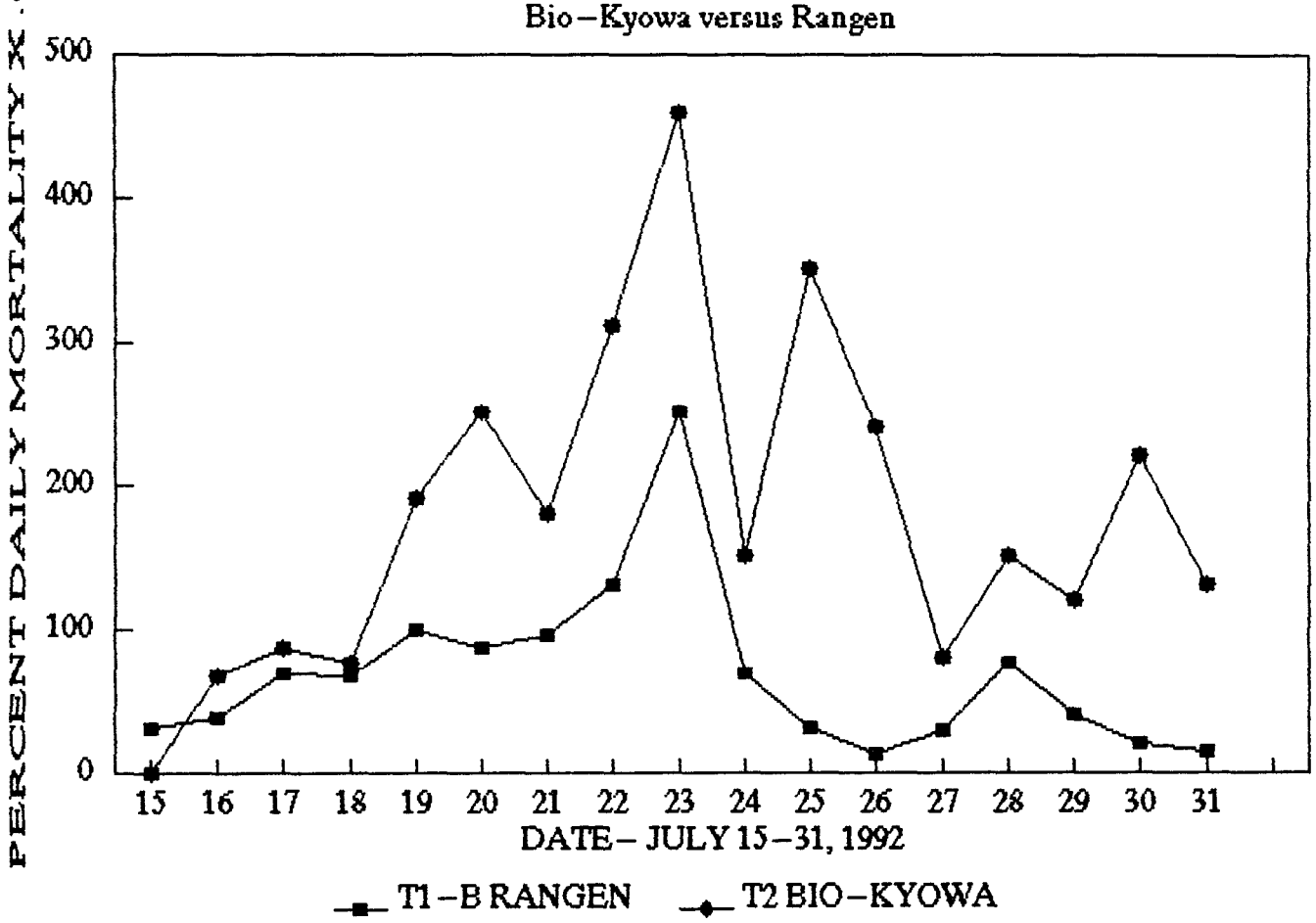



Figure 1: Location of Kootenai Tribal Experimental White Sturgeon Facility, RKM 241.3.

Figure 2. Kootenai River White Sturgeon egg survival to hatch in three water supplies at the Kootenai Hatchery in 1992.



# Figure 3. Kootenai Hatchery feed experiment



# Figure 4. Time allocations for Kootenai Hatchery Personnel